B3 辐照变色薄膜条或片

技术和使用信息

B3薄膜剂量计产品是WINdose与RisøScan 剂量系统的基石。批量生产的薄膜是在严格的质量标准下生产的，以确保一致性和稳定性。以下是一些技术细节和成功使用该产品的一些建议，更多细节，请联系GEX公司。

使用：

薄膜处理和切割：

B3薄膜在任何时候都需要非常小心的处理。辐照变色染料溶解其中的聚合物是PVB（聚乙烯醇缩丁醛），它具有很高的抗拉强度（它常被做成薄片用于制造汽车和建筑安全玻璃）。然而，由于该产品比较软，如果处理不当，很容易产生凹痕或备擦伤。当在任何表面上使用B3薄膜时，首先使用异丙醇清洁表面并让其彻底干燥。GEX公司推荐在处理该薄膜时使用无尘乳胶手套，以避免在薄膜表面留下油迹和残渣。

该薄膜上贴有衬底材料，它可以和衬底材料一起辐照，单在测量之前必须去除衬底。

该薄膜使用旋转裁纸机就可以相当容易的切成较小的片状。裁纸机是一个不贵的东西，有一个制造商叫Fiskars，访问他们的网站www.fiskars.com 并搜索旋转裁纸机。剪刀也是可以用于从薄膜卷上切割一定长度的薄膜条的简单的工具，但旋转裁剪机对于精确切割方形尺寸是相当有帮助的。该设备通常都配有公制和标准单位的测量指导。

波长和测量读出说明：

B3剂量计在其整个使用范围里，以前一直是使用554nm的波长进行测量的，而吸光度的波长峰值近来更接近于552nm。由于B3薄膜峰值较宽，介于550-555nm之间的任何固定波长的测量都被认为是可以接受的。作为一直选择，该薄膜可以在其整个峰值区域内被扫描，然后可以得到并成功使用其一个平均值或中间值。 剂量计应该使用GEX生产的剂量计保持架或经确认和RisøScan软件一起使用的光学扫描仪进行测量。

B3薄膜厚度：

GEX B3剂量计是大批量生产的、具有高度均匀性的产品，它允许用户在测量过程中采用一个平均剂量计厚度。GEX B3薄膜条和薄膜片的平均厚度和变化率没有明确。有关B3薄膜厚度的问题，请根据网站sales@gexcorp.com上的联系信息联系GEX公司。

剂量率影响：没有已知的剂量率影响。

辐照温度注意：

如果在温度高于60°C的情况下使用B3薄膜，用户需谨慎。

辐照前保存：

GEX公司提供不可逆温度标签用以监视所有B3薄膜运输过程中的最高温度。如果记录的温度达到或超过45 ℃，请直接向GEX报告以便决定响应的措施。包装对薄膜提供了保护，然而，用户应该将剂量计保存在一个受控的办公室或实验室环境里（参考随货发送的合格证）。

环境条件：辐照变色薄膜剂量计的响应函数受到辐照时的温度和薄膜材料里的含水量的影响。

UV紫外暴露：

B3辐照变色薄膜对紫外辐射很敏感，所以， 建议控制未受保护的薄膜剂量计暴露在日光和荧光灯下。

校准：

在近似于实际使用的条件下校准，这应该包括接近于实际加工条件的时间和温度条件。参考指引文件：ISO/ASTM 51261和NPL Report CIRM 29.

- 可使用校准范围：

1.0 kGy - 140 kGy或取决于用户应用场合及不确定度要求。使用多片包装的剂量片或校准多个计量范围可以使扩展不确定度大幅减小。

- 建议：

GEX推荐使用设计用于捕捉日常加工的任何条件的in-situ原位校准方法。使用合适的校准模型或等价物（如ISO/ASTM 51261 and NPL CIRM Report 29所述）来协作定位传递标准剂量计相对于被校准的常规剂量计在控制距离， 以保持可重现的、条件相当的几何图形（见查看资料）。

剂量计批校准应该在正常加工条件（包括温度）下完成。如果没有对辐照后（见下面）的剂量计使用热处理，剂量计应该在与日常生产剂量值测定一致的时间间隔后进行读取。这可以包括在多倍时间间隔时的读数，这些可以被分析以确定颜色形成周期的特性以及必要时用以确定颜色形成修正因子。

辐照后稳定性：

B3辐照变色薄膜材料在辐照后的着色要持续一段时间，导致测得的响应值一直在变化。为了快速完成剂量计响应，强烈推荐对B3薄膜剂量计采用辐照热处理以完成颜色形成周期及致使B3剂量计100%辐照后稳定。经恰当的热处理的剂量计保持稳定超过一年的时间。

GEX建议对所有的B3剂量计产品使用辐照后热处理。用户应该确认使用的热处理方法。以60-65 ℃进行的薄膜片的热处理通常是合适的。在热处理过程中不要把薄膜叠放在一起，以避免可能的粘合在一起。

静电和辐照变色薄膜表面：

静电条件可以导致微粒被吸引到剂量计表面从而导致读出误差。使用软刷或软的防静电布去除可见的微粒。

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B3 Film dosimeter products are the cornerstone of the WINdose and RisøScan dosimetry systems. Film Batches are manufactured under strict quality standards to ensure consistency and reliability. Below are some technical details and recommendations for successful use of the product. Contact GEX for additional details.

Usage:

Film Handling and Cutting: B3 film should be handled with extreme care at all times. The polymer in which the radiochromic dye is dissolved into is Polyvinyl Butyral, which has high tensile strength (it is used as a laminate to make automotive and architectural Safety Glass). However, because the product is soft it can be easily dented or scratched if not handled properly. When applying B3 film to any surface, clean the surface first using Isopropyl Alcohol and allow to dry thoroughly. GEX recommends wearing powder-free Latex gloves when handling the film to avoid leaving body oils or residues on the film surface.

The film has a polyester backing material attached. The film can be irradiated with the backing material still attached, but the backer must be removed before measurement.

The film is most easily cut into smaller sections using a Rotary paper trimmer. This is an inexpensive item, one manufacturer is Fiskars. Visit their website www.fiskars.com and search for rotary trimmers. Scissors can easily be used for cutting lengths of strips from a roll, but for cutting accurate and square sizes a rotary trimmer is extremely helpful and the units usually have measurement guides on them in both metric and standard units.

Wavelength and Measurement Readout Instructions: B3 dosimeters have historically been measured at 554nm over the entire range of use. The absorbance wavelength peak has more recently been approximated to be 552 nm. Because of the broad peak of the B3 film, measurement at any fixed wavelength between 550 – 555nm is considered acceptable. Alternatively the film can be scanned over the peak area and an average mean or median value can be obtained and used successfully. Dosimeters should be measured using a GEX manufactured dosimeter holder or an optical scanner validated for use with the RsøScan software.

B3 film thickness: GEX B3 dosimeters are manufactured in large, highly uniform batches that allow users to apply an average dosimeter thickness in the measurement process. An average thickness and variability is not specified for GEX B3 film strips and sheets. Contact GEX with questions related to the subject of B3 film thickness at sales@gexcorp.com.

Dose rate effects: There are no known dose rate affects.

Irradiation Temperature Caution: Use of B3 Film products in irradiation temperatures above 60°C are at the user's discretion.

Pre-Irradiation Storage: GEX provides irreversible thermal labels to monitor maximum temperature on all B3 film shipments. Report any recorded temperatures of 45 ℃ or higher directly to GEX so that appropriate actions can be determined. The packaging provides protection for the film, however, the user should store the dosimeters in a controlled office or laboratory environment (refer to the Certificate of Compliance which accompanies each shipment).

Environmental Conditions: The response function of radiochromic film dosimeters is affected by the temperature and the water content in the film material at the time of irradiation.

UV Exposure: The B3 radiochromic film is sensitive to UV radiation. Therefore, it is recommended to control exposure of unprotected film dosimeters to daylight and fluorescent light sources.

Calibration: Calibrate under conditions approximating actual usage. This should include time and temperature conditions that approximate actual process conditions. For guidance, see: ISO/ASTM 51261 and NPL Report CIRM 29.

- ***Usable Calibration Range*:** 1.0 kGy - 140 kGy or as determined by user's application and uncertainty requirements. Using multiple replicate packaged dosimeters or calibrating multiple dose ranges can result in significant reductions in expanded uncertainty.

- ***Recommendation:*** GEX recommends using an in-situ calibration method designed to capture routine process conditions whenever possible. Use an appropriate calibration phantom or equivalent (as described in ISO/ASTM 51261 and NPL CIRM Report 29) to co-locate the transfer standard dosimeters in controlled proximity to the routine dosimeters being calibrated taking care to maintain a repeatable geometry with equilibrium conditions (see references).

The dosimeter batch calibration should be accomplished under normal process (including temperature) conditions. If a heat-treatment is not applied to the dosimeters post-irradiation (see below), dosimeters should be read at a time interval consistent with routine production dosimetry. This may include readings at multiple time intervals, which are analyzed to determine the specifics of the color development cycle and to establish a correction factor for color development if necessary.

Post Irradiation Stability: The coloration of B3 radiochromic film material may continue to develop for some period of time after irradiation, causing the measured response values to change. To complete the dosimeter response rapidly it is strongly recommended to apply post irradiation heat treatment to B3 film dosimeters to complete the color development cycle and render B3 dosimeters 100% post irradiation stable. Dosimeters that have been properly heat treated will remain stable for more than a year.

GEX recommends a post-irradiation heat treatment process be used for all B3 dosimeter products. The user should validate the heat treatment method used. Treatment of film sheets at 60-65 ℃ is typically appropriate. Do not overlap films onto one another during the process to avoid the possibility that they may stick together.

Static and Radiochromic Film Surface: Static electricity conditions may cause particulate to be drawn to the dosimeter surface that can cause readout error. Remove visible particulate with a soft brush or piece of soft anti-static cloth.

References:

1) "A New Radiochromic Thin Film Dosimeter System", A. Miller et al, Radiation Physics and Chemistry Volume 31 pp. 491-496, 1988 International Journal Radiation Applications and Instrumentation, Part C. Printed in Great Britain.

2) ISO/ASTM Standard Practice 51275 - Standard Practice for Use of a Radiochromic Film Dosimetry System.

3) ISO/ASTM Standard Guide 51261 - Standard Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing. NPL Report CIRM 29; Guidelines for the Calibration of Dosimeters for Use in Radiation Processing.

4) "Temperature, Humidity and Time. Combined Effects on Radiochromic Film Dosimeters", A. A. Abdel-Fattah and Arne Miller, Radiation. Phys. Chem. Vol. 47, No. 4, pp.611-621, 1996; Elsevier Science Ltd, Great Britain.

5) "Guidelines for the Calibration of Dosimeters for use in Radiation Processing", Peter Sharpe and Arne Miller, Report CIRM 29.